THE CANADIAN AIDS TO NAVIGATION SYSTEM

DEPARTMENT
OF
TRANSPORT

AIDS
TO
NAVIGATION

CAUTIONARY NOTE

The following information describes the Canadian Aids to Navigation System that is being implemented and will be completed by the opening of navigation 1971.

During this changeover, mariners may observe the old as well as the new system in use and are cautioned to be aware of this fact.

Through broadcasts, written Notices to Shipping, and Notices to Mariners, mariners will be advised of the changes as they occur.

Possibly, the most significant change is the establishment of standard light phase characteristics and the change in the light colour of port hand buoys from white to green.

Cat. No.: T31-2969

CANADIAN AIDS TO NAVIGATION SYSTEM

GENERAL

The *Department of Transport,* through its Aids to Navigation Division, maintains the Aids to Navigation System in Canada.

Navigation as it applies to the Mariner is the science of manoeuvring a vessel safely from place to place and the ability to determine the vessel's position, course and distance travelled to achieve this objective.

Aids to Navigation in the Canadian System are devices external to a vessel that are maintained for the marine navigator's use to assist him in confirming his position and course or to warn him of dangers or obstructions that might exist nearby.

Some of the *devices* employed as aids to navigation in Canada are buoys, lighthouses, fog signals, radio beacons and radar reflectors, etc., and such aids should be used in conjunction with available marine publications such as charts, light lists, sailing directions, which are also known as "Pilots", for proper understanding and interpretation of their function.

Certain aids to navigation, such as buoys and minor lights, are not under continuous observation and experienced mariners are aware that with the many thousands of aids in Canada, it is not always possible to maintain them as advertised without some failures and displacements occurring. The Department does not guarantee that aids to navigation will be maintained at all times and from time to time, or will be maintained and operated as advertised. Mariners observing outages, buoys off location or other malfunctions are responsible for reporting such to the nearest Marine Services Base, Marine Radio Coast Station or Chief, Aids to Navigation, Ottawa. Atmospheric conditions have considerable effects on light and sound transmission and mariners are cautioned to be aware of this problem.

A knowledge of the significance of starboard hand and port hand in the Aids to Navigation System is a prerequisite of the mariner. When travelling into a harbour, up a river, to a head water or with the flood tide, starboard hand aids are those to the vessel's starboard or right. Similarly, port hand aids are those to the vessel's port or left.

FIXED STRUCTURES

Fixed Structures are major or minor structures located at prominent sites near waterways to assist the mariner to fix his position. They may be at shorelines, on islands, or on built-up, man-made piers in or near waterways.

The *Types* of structures used in Canada are varied and may have vertical or tapering sides; circular, square, polygonal or octagonal in section; and constructed of wood, masonry, concrete or metal. Others may be slender cylindrical structures, such as pipes, poles, skeleton steel towers, or tripod structures.

The characteristics of such aids are for identification purposes and they consist of the light characteristic by night and the colour, type of construction and shape of the structure by day, as published in the appropriate List of Lights, Buoys and Fog Signals publications. Such characteristics usually have no lateral significance to the direction of the channel or waterway being used.

DAYBEACONS

Although the majority of fixed structures support and display a navigation light for night navigation, a limited number do not where night navigation is negligible or where it is not possible to operate a light due to certain conditions. *Daybeacons* are used to assist the mariner under such circumstances.

Colour, shape and possibly a number are the characteristics which identify their significance to the mariner. A light is not normally used with such aids and therefore retro-reflective material is applied to the daybeacon so as to give colour, shape and possibly a number characteristic for use by the mariner at night, in conjunction with the use by the vessel of a searchlight for locating such an aid.

Starboard daybeacons are triangular in shape, with a red fluorescent triangular centre, surrounded by a white border and this, in turn, surrounded by a red retro-reflective border. A white retro-reflective even number may be displayed on the centre portion.

Port daybeacons are square in shape with a black square centre surrounded by a white border and this in turn surrounded by a green retro-reflective border. A white retro-reflective odd number may be displayed on the centre portion.

Junction daybeacons are diamond in shape with a red fluorescent triangle and black rectangle in the centre on a white background with a red fluorescent border and surmounted with red and green retro squares on the corners. The red fluorescent triangle pointing up denotes that the preferred channel is to the left. Similarly, the black rectangle up denotes that the preferred channel is to the right.

FOG SIGNALS

Fog Signals are fixed, sound-producing aids to warn of dangers during adverse weather conditions where other visual aids are obscured.

Distinctive sound and signal characteristics identify the aids to the mariner as advertised in the appropriate List of Lights, Buoys and Fog Signals publication.

LIGHTSHIPS

Lightships are aids to navigation established in exposed locations near an obstruction where a fixed pier has not to date been constructed. These vessels are painted red and display the name of the station in large white letters on both sides of the hull. At night, a proper navigation light is in operation. Fog and radiobeacon signals are also provided and are identified as published in appropriate aids to navigation publications.

When lightships are required to leave their station for any length of time, a large type buoy is usually placed to mark the vacated position.

NOTE: In Canada, only one lightship now exists, namely LURCHER LIGHTSHIP, which is located westerly of Yarmouth, N.S.

RADAR REFLECTORS

Certain fixed shore structures and buoys are equipped with special fixtures designed to improve the ability of the aids to reflect radar signals. Aids so equipped are advertised in the appropriate List of Lights, Buoys and Fog Signals publications and symbolized on charts.

RADIOBEACONS

Marine radiobeacon stations provide a navigational aid to mariners by transmitting a signal on which bearings may be taken by ships, and operate within the radio frequency band 285 to 325 kHz.

These radiobeacons normally operate in groups of six on the same frequency, each station transmitting during a one minute period in sequence with the other stations in the group. For example, station A may commence transmission at H + 00 (Sequence 1) and transmit its characteristic during the first minute; at H + 01 (Sequence 2) station B will start, and at H + 02 (Sequence 3), when B has stopped, station C will commence. The radiobeacons operate thus in sequence continuously, with no distinction being made between fair and foul weather operation. The characteristic of each station consists of a distinguishing code letter transmitted three times as shown in Radio Aids to Marine Navigation. Less than six radiobeacons may be assigned to a particular group, in which case one or more of the beacons may transmit during two of the six one minute periods.

As exceptions to this normal sequenced operation, certain radiobeacons offer a service to aviation as well as to marine users, and operate continuously in the 200 to 400 kHz band.

Also, in areas where there is a limited marine requirement, radiobeacons may operate singly. Such radiobeacons normally transmit their characteristic for one minute in every ten minutes continuously, using continuous carrier and tone-keyed modulation. This type of automatic radiobeacon is designed to operate unattended for long periods of time in areas which are isolated or inaccessible for part of the year. These beacons have a range of approximately 100 miles.

Most United States radiobeacons may be distinguished from their Canadian counterparts by the fact that their characteristics consist of a single code letter repeated for fifty seconds, followed by a ten second dash. United States and Canadian radiobeacons may be operated in common sequenced groups by mutual agreement.

All mariners should understand the limitations of radiobeacons and the receiving equipment and the possible erroneous bearings that may result.

LORAN

Loran is a system of position finding based on the difference in the time of arrival of pulse type radio unmodulated signals transmitted from a pair of fixed stations. The time difference is measured on a Loran receiver and is used in conjunction with specially prepared charts or tables to establish a line of position. The intersection of two or more lines of position determined from two or more pairs of Loran stations provides the position of the receiving station.

Two systems are in use in Canada, Loran A and Loran C. Loran A stations operate in the band 1750-1950 kHz. Loran C operates on the 100 kHz and is superior in range and accuracy.

Mariners should understand that the accuracy of Loran is dependant on a number of factors as well as the skill of the operator.

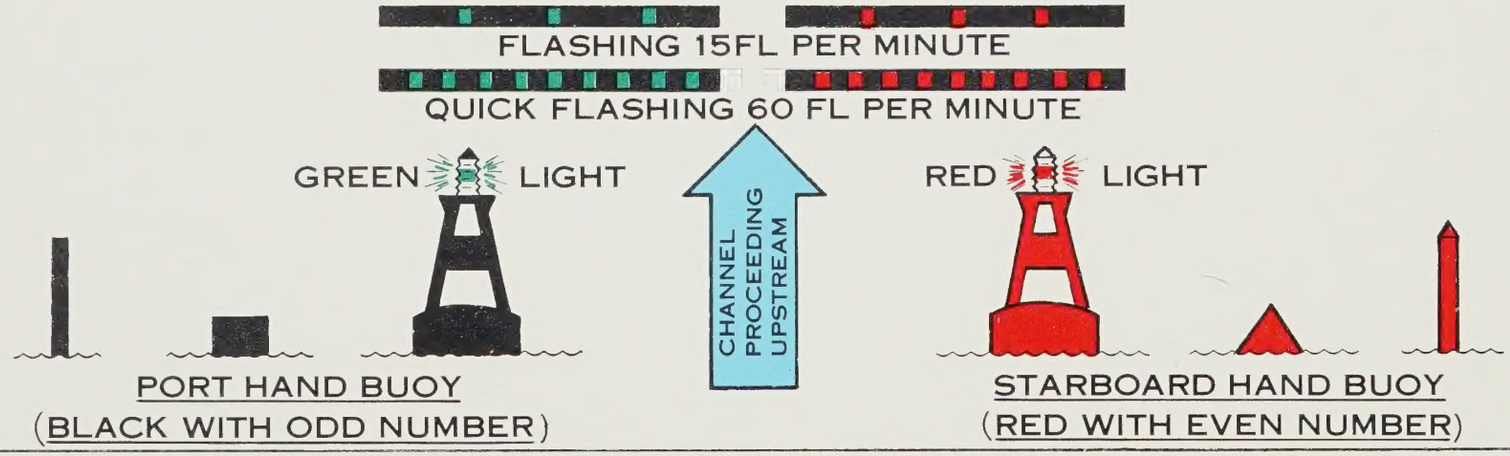
DECCA

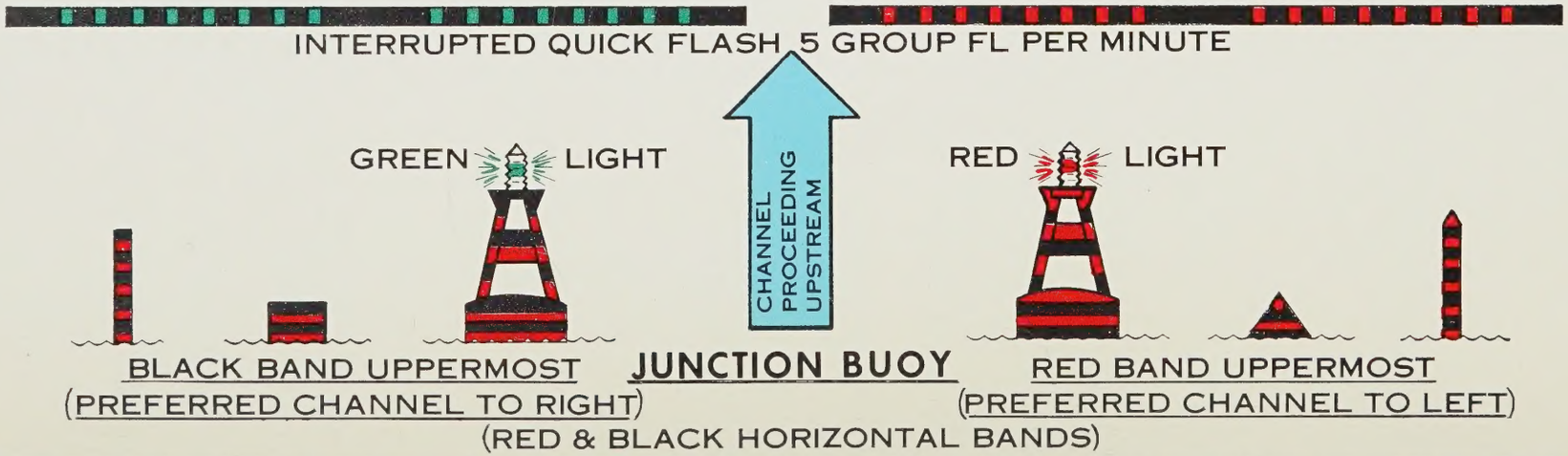
The Decca Navigator System is based on the phase comparison of CW transmissions from three of four stations operating in the 70-130 kHz band. They are known as Master and Red, Green and Purple Slaves. The slaves are at distances of from 70 to 100 miles from the Master, but neither direction nor distance is critical. The range of the system is approximately 250 miles during the day, with reduced coverage at night due to night effects.

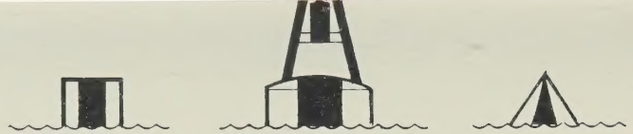
Mariners should understand that the accuracy of Decca is dependant on a number of factors as well as the skill of the operator.

CANADA

NORMAL NAVIGATION BUOYS



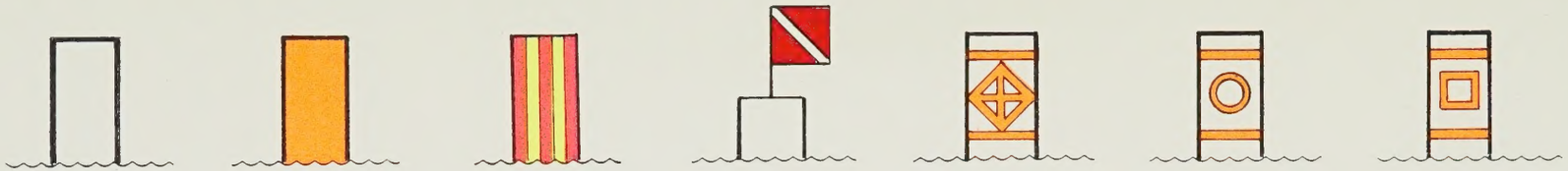




FAIRWAY BUOY

(BLACK & WHITE VERTICAL STRIPES)

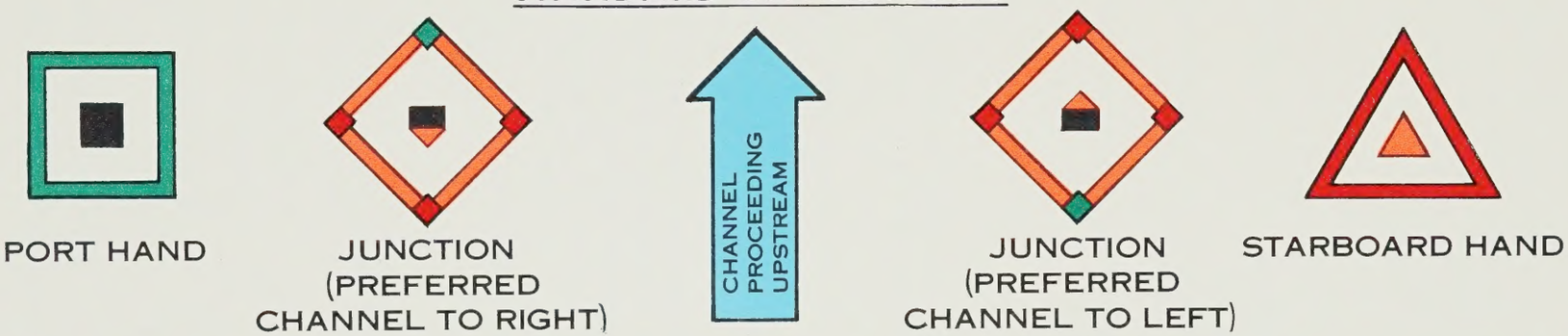
SPECIAL PURPOSE BUOYS



ANCHORAGE | CAUTIONARY | SCIENTIFIC | SKIN DIVERS | KEEP-OUT | CONTROL | INFORMATION

NO LATERAL SIGNIFICANCE, NO SPECIAL SHAPE, NO NUMBERS, MAY BE LETTERED, MAY CARRY A LIGHT

STANDARD DAYBEACONS



PORT HAND

JUNCTION (PREFERRED CHANNEL TO RIGHT)

JUNCTION (PREFERRED CHANNEL TO LEFT)

STARBOARD HAND

AIDS TO NAVIGATION, DEPARTMENT OF TRANSPORT

NAVIGATION BUOYS

General

A lateral system of buoyage is used in Canadian waters. Mariners are encouraged to make use of proper navigation charts with this system. Through a combination of one or several visual and/or physical characteristics such as shape, colour, numbers, colour of displayed light, and light phase characteristics, the safe or navigable side that a buoy may be passed is indicated from a certain "direction".

Direction

These characteristics are established in relation to the position of the buoy to the safest or navigable water or channels as they are entered from seaward to the head of navigation, i.e. into a harbour, up a river, with the flood tide. Where an off-shore series of coastal buoys exist, and the previous "direction" factors cannot be applied, it shall be arbitrarily assumed that proceeding in a southerly direction along the Atlantic Coast, in a northerly direction along the Pacific Coast, is proceeding from seaward. It is important for the mariner to appreciate the importance of "direction" in order to understand the hand of buoys.

Shapes of Buoys

The characteristic of shape is applicable only to certain unlighted buoys that would aid the mariner to determine the safest channel.

(1) Unlighted buoys with pointed tops (either conicals or spars) indicate that the safe or preferred channel is to port (left) of such buoys.

(2) Unlighted buoys with flat tops (either cans or spars) indicate that the safe or preferred channel is to starboard (right) of such buoys.

Colour of Buoys

All buoys have a colour which is one of their major characteristics for indicating to the mariner the location of safe water. However, if a buoy carries a light, the lantern for the light shall not be of a significant colour but shall bear the neutral colour white.

(1) *Red buoys* are used to mark (a) the starboard (right) side of channels; or (b) the left side of shoals, wrecks, or other obstructions and as such the buoy must be kept on the vessel's starboard (right) hand.

(2) *Black buoys* are used to mark (a) the port (left) side of channels; or (b) the right side of shoals, wrecks, or other obstructions and as such the buoy must be kept on the vessel's port (left) hand.

(3) *Red and black buoys* horizontally banded are used to mark (a) junctions of channels; (b) middlegrounds; or (c) shoals, wrecks or other obstructions which may be passed on either side. If the uppermost band of such a buoy is red, it indicates that the preferred channel or safer water is to the port (left) and the buoy should be kept on the vessel's starboard (right) hand. If the uppermost band is black, it indicates that the preferred channel or safer water is to the starboard (right) and the buoy should be kept on the vessel's port (left) hand.

(4) *Black and white buoys* vertically striped are used to mark (a) a fairway; (b) or mid channel separation. In either case the buoy may be passed on either side and reasonably close to the buoy.

Numbering of Buoys

Buoys shall normally display numbers if they are solid red or solid black in colour. Other buoys not of a hand shall not display a number but may carry a letter or name for the purpose of identification.

Buoys that are solid red in colour (starboard hand) shall display even numbers.

Buoys that are solid black in colour (port hand) shall display odd numbers.

Numbers as well may be suffixed by a letter in order to facilitate identification.

Colour of Lights

Three colours of lights are used on navigation buoys, namely, red, green and white.

Red lights are used on lighted red buoys and on lighted red and black horizontally banded buoys if the preferred channel is to the port (left).

Green lights are used on lighted black buoys and on lighted red and black horizontally banded buoys if the preferred channel is to the starboard (right).

White lights are used only on lighted black and white vertically striped buoys.

LIGHT PHASE CHARACTERISTICS

A *Flashing* (Fl) characteristic is used on port and starboard hand buoys. It consists of 15 flashes per minute.

A *Quick Flashing* (QkFl) characteristic is used on port and starboard hand buoys where a distinct cautionary emphasis is desired, i.e., a sharp turn in a channel, a wreck or other obstruction. It consists of 60 flashes per minute.

An *Interrupted Quick Flashing* (IntQkFl) characteristic is used on junction buoys or middle ground locations such as wrecks or other obstructions that can be passed on either side. It consist of a series of 8 flashes followed by a dark period every 12 seconds.

A *Morse Code Letter A* (Mo (A)) is used on fairway buoys or on mid-channel traffic separation buoys. It consists of a short flash followed by a long flash every 6 seconds.

REFLECTORS

A number of unlighted buoys are fitted with reflective material or reflector buttons so as to assist the mariner at night to locate the buoy when using a searchlight. When so equipped,

(a) red buoys shall reflect red light.
(b) black buoys shall reflect green light.
(c) red and black buoys shall reflect red or green light.
(d) black and white buoys shall reflect white light.

SOUND

A number of buoys are fitted with sound producing devices which are activated by the motion of the buoy in water. Two such devices are a bell and a whistle (groaner).

As such sound has no regularity and cannot be controlled, no lateral significance can be related and therefore such sounds act only as a warning during periods of low visibility.

TYPES OF NAVIGATION BUOYS

From the above characteristics four basic navigation type buoys are utilized, namely, port hand, starboard hand, junction and fairway.

A "Port Hand Buoy" when proceeding in *the* certain direction shall mark the port (left) side of a channel or safe passage and be painted black and

(1) if it displays a light, the light shall be green with a Flashing (Fl) or Quick Flashing (QkFl) characteristic.
(2) if it displays reflective material, it shall show green.
(3) if it does not display a light, it shall have a flat top.
(4) if it displays a number, it shall be an odd number.
(5) it may or may not carry a radar reflector or sounding device.

A "Starboard Hand Buoy" when proceeding in *the* certain direction shall mark the starboard (right) side of a channel or safe passage and be painted red and

(1) if it displays a light, the light shall be red with a Flashing (Fl) or Quick Flashing (QkFl) characteristic.
(2) if it displays reflective material, it shall show red.
(3) if it does not display a light, it shall have a pointed top.
(4) if it displays a number, it shall be even.
(5) it may or may not carry a radar reflector or sounding device.

A "Junction Buoy" when proceeding in *the* certain direction shall mark channel junctions, middlegrounds, wrecks or other obstructions that may be passed on either side and be painted with red and black horizontal stripes and

(1) if it displays a light, the light shall be red or green with an Interrupted Quick Flashing (IntQkFl) characteristic.
(2) if it displays reflective material, it shall show red or green.
(3) if it does not display a light, it shall have either a flat or a pointed top depending on the preferred channel.
(4) it may display a letter or name for identification.
(5) it may or may not carry a radar reflector or sounding device.

A "Fairway Buoy" shall mark the entrances to harbours, a fairway or a mid-channel separation and be painted with black and white vertical stripes and

(1) if it displays a light, the light shall be white with a Morse Code Letter A (Mo(A)) characteristic.
(2) if it displays reflective material, it shall show white.
(3) it may display a letter or name for identification.
(4) it may or may not carry a radar reflector or sounding device.

SPECIAL PURPOSE BUOYS

Special purpose buoys may be found in Canadian waters in addition to the normal type navigation buoys and are described as follows:

1. An "Anchorage Buoy" shall be used to mark the extremities of a designated anchorage area and shall be painted white and

   (a) if it displays a light, the light shall be white with a Flashing (Fl) characteristic.

   (b) if it displays reflective material, it shall show white.

   (c) it may display a letter or name for identification.

   (d) it may or may not carry a radar reflector.

2. A "Cautionary Buoy" shall be used to mark areas where mariners are to be warned of dangers other than shoals, rocks, etc. such as National Defence exercise areas, racing courses, seaplane bases and shall be painted international orange or fluorescent orange and

   (a) if it displays a light, the light shall be white with a Quick Flashing (QkFl) characteristic.

   (b) if it displays reflective material, it shall show orange.

   (c) it may display a letter or name for identification.

   (d) it may or may not carry a radar reflector.

3. A "Scientific or Oceanographic Buoy" shall be used to indicate a scientific, meteorological, or oceanographic station, either free floating or anchored and shall be painted with wide vertical stripes of fluorescent red and fluorescent yellow if anchored or wide horizontal bands of fluorescent red and fluorescent yellow if free floating and

   (a) if it displays a light, the light shall be white with a quick flash for 4 seconds followed by a period of darkness for 16 seconds.

   (b) if it displays reflective material, it shall show red and yellow.

   (c) it may display a letter or name for identification.

   (d) it must carry a radar reflector or be a good radar target.

   (e) it may or may not carry a sounding device.

4. A "Skin Divers Buoy" shall be used to indicate that skin diving activity is present and shall be painted white and shall be surmounted by a red flag not less than 20 inches in either length or breadth with a white diagonal stripe from the top of the hoist to the bottom of the fly.

5. A "Keepout Buoy" shall be used to mark a prohibited area to exclude boats such as a designated swimming area or a designated non-boating area and shall be painted white and shall display an open-faced fluorescent orange diamond with a vertical fluorescent orange cross symbol on a white background. It shall also display two fluorescent orange horizontal bands, one above and one below the symbol.

6. A "Control Buoy" shall be used to indicate a speed limit, no wash, no mooring, etc. and shall be painted white and shall display an open-faced fluorescent orange circular symbol on a white background. It shall also display two fluorescent orange horizontal bands, one above and one below the symbol.

7. An "Information Buoy" shall be used to display information such as a locality name, marina, camp site, etc. and shall be painted white and shall display an open-faced fluorescent orange square or rectangle symbol on a white background. It shall also display two fluorescent orange horizontal bands, one above and one below the symbol.